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Description

Arrangement and process for organizing flat items of mail

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The invention relates to an arrangement and to a process for organizing flat items of mail according to the preamble of claims 1 and 11.

10 Certain tasks, in particular mail delivery, require the items of mail present to be stacked in a certain order which corresponds, for example, to the sequence of the delivery points (of the so-called route taken by the mail-delivery person). In this case, the address which
15 appears on the item of mail, and corresponds to a delivery point, constitutes the organizing criterion, while the sequence of the delivery points constitutes the organized order which is to be produced.
In order to organize items in a certain order,
20 EP 820 818 A1 has disclosed a solution which utilizes an intermediate store which comprises pockets or similar elements which each receive an item of mail and, on command, can discharge it again into the actual depositing compartment. In this case, initially all the
25 items of mail which are to be organized are accommodated in any desired order in the pockets of the intermediate store. Then, the items of mail are removed from the pockets of the intermediate store, and transferred into the depositing compartments, such that
30 they are located in the latter in the organized order which is to be produced. A dedicated depositing receptacle is provided for each item of mail. The sorting takes place with two circulating cycles of the pockets of the intermediate store, one circulating cycle for filling the pockets and a further circulating
35 cycle for emptying the pockets.

A large number of depositing compartments, however, is necessary for this purpose, each depositing compartment

having to be equipped with a control mechanism which causes the item of mail to be transferred from the correct pocket of the intermediate store.

Another, frequently used process, referred to as a multi-pass or radix sort process, for organizing items of mail is based on the items of mail passing through the same sorting arrangement a number of times, a separate control program being used in each pass. It is thus possible to manage with a small number of stacking compartments in relation to the number of delivery points. The disadvantages of this process are constituted by the large amount of time required, relatively high error rates and the relatively pronounced mechanical loading to which the items of mail are subjected on account of passing through the sorting machine a number of times (DE 43 02 231 C2, DE 197 14 184 A1).

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The invention explained in claims 1 and 11 is based on the object of providing an arrangement and a process for organizing flat items of mail according to the preambles with a reduction in the number of depositing receptacles and of associated control elements in relation to the prior art, and with the items of mail only being separated and read once in a sorting run, said arrangement and process also making it possible to reduce the amount of effort required on the part of the operator and to include pre-sorted items of mail with low sorting outlay.

The design of the depositing receptacles for receiving a plurality of flat items of mail as stacks and the operation of sorting or organizing the items of mail in a number of circulating cycles of the containers, which circulate in a closed loop and in which the items of mail located in the containers, according to their address information, are discharged to the depositing receptacles in a controlled manner in accordance with a definable sequence of delivery points assigned to the

recipient addresses, the order of the items of mail in each depositing receptacle corresponding to the sequence of the delivery points assigned to the addresses of the items of mail located in the respective depositing receptacle, makes it necessary to have only a small number of depositing receptacles and thus only a small number of diverters and control elements for discharging items of mail.

Advantageous configurations of the invention are specified in the subclaims. Arranging the depositing receptacles in two rows which are aligned parallel to one another, at a distance apart, and horizontally makes it possible for the items of mail to be removed straightforwardly from the depositing receptacles.

If certain delivery points are fixedly assigned to the respective depositing receptacles, then all the items of mail which are intended for a certain delivery zone are always located in one depositing receptacle. This assignment is defined before the recipient addresses of the items of mail which are to be organized are known. This is necessary if these items of mail are to be handled separately from items of mail for other delivery zones.

If the depositing receptacles are to be filled uniformly, then it is advantageous, with knowledge of the address, for the items of mail to be assigned flexibly to the depositing receptacles such that in each case approximately equal numbers of items of mail are located in the depositing receptacles or, in the case of the thicknesses of the individual items of mail being measured, the stacks are of approximately equal height.

The further configuration of the invention where the depositing receptacles are subdivided into two groups and, in the case of organizing sorting runs proceeding

one after the other, the items of mail of different address areas are alternately sorted only into one of the two depositing-receptacle groups, allows staggered processing, i.e. while the items of mail for one address area are transported out of the compartments into the depositing receptacles, the still full depositing receptacles of the other address area are emptied at the same time. This means that only one operator is necessary, and he/she need not simultaneously empty depositing receptacles and introduce items of mail for separation.

Furthermore, it is advantageous for the operations of sorting the items of mail of the two groups to overlap in time such that items of mail of one group are loaded into empty containers while the operation of emptying into the depositing receptacles the items of mail filled with items of mail of the other, previous group is still proceeding. This makes it possible to increase the sorting throughput. In order for this overlapping operation to take place effectively, in a further configuration, the loading location of the containers can be moved in a controlled manner such that the item of mail which is to be loaded in each case can be loaded, without any loading delay, into an already empty container located in the defined movement range.

According to another development, it is possible for pre-sorted items of mail to be included in the organizing process such that the smallest possible number of circulating cycles of the containers is necessary and it is possible to organize more items of mail than there are containers present. For this purpose, once the non-sorted items of mail have been loaded into the containers, the pre-sorted items of mail are loaded into the still empty containers or the containers which are becoming empty as a result of being emptied into the depositing receptacles. The delivery points are assigned place numbers in accordance with their order in the respective depositing

receptacles, and the pre-sorting operation takes place such that the items of mail which are assigned to the delivery points with the lower place numbers can be separated before the items of mail with the higher place numbers.

In conjunction with the pre-sorted items of mail included, it is, moreover, advantageous for the non-sorted items of mail of the current address area to be loaded into empty circulating containers even when items of mail of the preceding address area are still located in containers, i.e. this emptying operation has not yet been completed. This makes possible a further increase in the output capacity during the sorting operation since the situation where containers stand empty during the sorting operation is largely avoided.

An exemplary embodiment of the invention is explained in more detail hereinbelow with reference to the drawings.

In the drawings:

figure 1 shows a schematic illustration of the circulating containers being loaded, without overlapping operation,

figure 2 shows a schematic illustration of the containers being emptied into depositing receptacles, without overlapping operation,

figure 3 shows the time sequence of the organizing sorting, without overlapping operation,

figure 4 shows the time sequence of the organizing sorting of items of mail of a plurality of address areas into two depositing-receptacle groups, without overlapping operation,

figure 5 shows the time sequence of the organizing sorting of items of mail of a plurality of address areas into two depositing-receptacle groups, with overlapping operation,

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figure 6 shows the time sequence of the organizing sorting with pre-sorted items of mail, without overlapping operation,

10 figure 7 shows the time sequence of the organizing sorting, with pre-sorted items of mail, into two depositing-receptacle groups, with overlapping operation, and

15 *Mark B3* ~~figure 8 shows the sequence of the organizing process with pre-sorted items of mail in a number of circulating cycles of the containers.~~

According to figures 1 and 2, the items of mail are
20 sorted in a sorting arrangement having an intermediate store, which comprises containers 1, 4 circulating in a closed loop, and having a series of depositing receptacles 2, the depositing receptacles 2 being envisaged for receiving more than one item of mail 3 in
25 organized fashion, with the result that the number of depositing receptacles 2 can be kept considerably smaller than the number of containers 1, 4. It is, however, the case that a number of circulating cycles of the containers 1, 4 of the intermediate store are
30 necessary in order for all the items of mail 3 to be transferred from the containers 1 into the depositing receptacles 2.

The organizing operation takes place in the following
35 steps:

1. Transporting an addressed item of mail 3 past a reading arrangement into a free container 4 of the circulating intermediate store.

2. Determining the address or suitable information on the item of mail 3.
 3. Repeating steps 1 and 2 until all the items of mail 3 are located in each case in one container 1 of the intermediate store.
 5. As soon as an item of mail 3 is located above that depositing receptacle 2 into which, with account being taken of the address information read from all the items of mail 3 located in the containers 1, it has to be deposited before all other items of mail in order to produce the desired organized order, the container 1 is opened and the item of mail 3 is deposited in said depositing receptacle 2.
 10. When all the containers 1 are empty, the items of mail 3 located in the form of sub-stacks 5 in the depositing receptacles 2 are removed therefrom in order and, if appropriate, combined to form one or more stacks.
 15. 5. Repeating steps 1 to 5, if appropriate, for the next address area.
 20. 6. Repeating steps 1 to 5, if appropriate, for the next address area.
- Figure 3 illustrates the time sequence of the abovedescribed process steps for a single address area.
- Introduction = steps 1 to 3
25 Destacking = step 4
Emptying = step 5

The assignment between the items of mail 3 which are to be organized and all belong to a defined address area (corresponds to one or more delivery areas) and the depositing receptacles 2 is determined, in a first variant, by groups of addresses (delivery points) being assigned to the depositing receptacles 2, with the result that a depositing receptacle 2 is clearly assigned to each address. The groups of addresses assigned to the individual depositing receptacles 2 correspond in each case to a continuous section of the organized order which is to be produced.

As an example, the following organized order of the items of mail 3 is to be produced in accordance with addresses for a single address area:

- A-Street 1 → A-Street 3 → A-Street 5 → A-Street 7 →
 5 B-Lane 8 → B-Lane 7 → B-Lane 6 → B-Lane 5
 → B-Lane 3 → B-Lane 2 → A-Street 2 → A-Street 4 →
 A-Street 6 → A-Street 8 → C-Avenue 1 → C-Avenue 2 →
 C-Avenue 3 → C-Avenue 4 → C-Avenue 5 → C-Avenue 6 →
 C-Avenue 7
 10 Assignment of the addresses to the depositing receptacles:

Depositing Receptacle 1	Depositing Receptacle 2	Depositing Receptacle 3
A-Street 1	B-Lane 6	A-Street 8
A-Street 3	B-Lane 5	C-Avenue 1
A-Street 5	B-Lane 3	C-Avenue 2
A-Street 7	B-Lane 2	C-Avenue 3
B-Lane 8	A-Street 2	C-Avenue 4
B-Lane 7	A-Street 4	C-Avenue 5
	A-Street 6	C-Avenue 6
		C-Avenue 7

- The assignment of the addresses to the depositing receptacles 2 is not made dependent on how many and/or on what kind of items of mail 3 which are to be organized are actually present for the individual addresses. Rather, this assignment has been defined before the addresses of the items of mail 3 which are to be organized are known.
 15 20 The advantage of such a fixed assignment consists in that all the items of mail which are intended for a certain delivery zone are always located in one depositing receptacle 2, and these items of mail are to be kept separate from the items of mail for other delivery zones (the items of mail are not combined to form an overall stack).

As an alternative to this, it is possible, for the purpose of optimizing the filling of the depositing

receptacles 2, for the assignment between the items of mail 3 which are to be organized and the depositing receptacles 2 to be defined only once all the items of mail are located in the containers 1 of the intermediate store.

This defining operation takes place either such that, at the end, an essentially equal number of items of mail 3 is located in each of the depositing receptacles 2 or that the mail stacks 7 which are located in each of the depositing receptacles 2 at the end are of essentially equal thickness.

The advantage of such flexible assignment consists in that the risk of depositing receptacles 2 overflowing is reduced, or in that only as many depositing receptacles 2 of the sorting arrangement are occupied as are necessary for the given quantity of items of mail 3 which are to be organized without said depositing receptacles overflowing.

If the depositing receptacles 2 are combined into two essentially equally sized groups, which are each assigned a separate address area for which items of mail 3 are to be organized, then it is simultaneously possible for items of mail 3 for a given address area to be deposited in the depositing receptacles 2 of one group while items of mail 3 are still located in the depositing receptacles 2 of the other group, which latter items of mail were previously deposited therein and can now be removed.

The advantage consists in that an operator can keep up with the sorting arrangement in that, rather than having to take place at the same time as the operation of filling the intermediate store, it is possible to utilize, for the operation of emptying the depositing receptacles 2, that period of time during which the items of mail are transferred (automatically) from the containers 1 of the intermediate store into the depositing receptacles 2.

Figure 4 illustrates the corresponding time sequence of the process steps for the case where items of mail for

a number of address areas are to be organized one after the other.

This process can be carried out more effectively in terms of time if steps 1 to 3 (filling the intermediate store) for the items of mail of the current address area are carried out while items of mail of the preceding address area are still located in the containers 1 and are being transported into the depositing receptacles 2. It is a prerequisite for the advantageous use of this variant that the sorting arrangement allows the intermediate store to be filled continuously, in a manner in which it essentially keeps up with the emptying of the intermediate store, even when an essentially variable number of (occupied) containers 2 is located between two (empty) containers 2 which are to be filled one after the other, e.g. an empty compartment is followed by 5 occupied compartments, this is followed by an empty compartment, the latter is followed by 8 occupied compartments, this is followed by an empty compartment, the latter is followed by 2 occupied compartments etc. This makes it possible to organize considerably more items of mail in the same period of time.

Figure 5 illustrates the corresponding time sequence of the process steps for this purpose.

In the case of a fixed depositing-receptacle/address assignment, it is possible for those items of mail which are already present in an organized state to be advantageously combined with those which have still to be organized, with the result that it is possible to introduce into the organized order which is to be produced more items of mail than the sorting arrangement has storage spaces (containers).

For the efficiency of this process, observing the following conditions is essential:

- Only items of mail which are intended for the same previously defined address area (corresponds to one or more delivery areas) are processed together.

- Within each group of addresses which are assigned to a depositing receptacle in each case, the addresses (delivery points) are numbered continuously (fictitious place number), beginning at 1, in accordance with the organized order which is to be produced.
- The organized order in which the organized quantity of items of mail have to be present has all the addresses (delivery points) with a lower place number preceding the addresses (delivery points) with a higher place number.

According to the previous example, the organized order of the addresses for a single address area which is to be produced is as follows:

- 15 A-Street 1 → A-Street 3 → A-Street 5 → A-Street 7 →
 B-Lane 8 → B-Lane 7 → B-Lane 6 → B-Lane 5 → B-Lane 3
 → B-Lane 2 → A-Street 2 → A-Street 4 → A-Street 6 →
 A-Street 8 → C-Avenue 1 → C-Avenue 2 → C-Avenue 3 →
 C-Avenue 4 → C-Avenue 5 → C-Avenue 6 → C-Avenue 7
- 20 Assignment of the addresses to the depositing receptacles and fictitious place numbers:

Fictitious place number	Stacking compartment 1	Stacking compartment 2	Stacking compartment 3
1	A-Street 1	B-Lane 6	A-Street 8
2	A-Street 3	B-Lane 5	C-Avenue 1
3	A-Street 5	B-Lane 3	C-Avenue 2
4	A-Street 7	B-Lane 2	C-Avenue 3
5	B-Lane 8	A-Street 2	C-Avenue 4
6	B-Lane 7	A-Street 4	C-Avenue 5
7		A-Street 6	C-Avenue 6
8			C-Avenue 7

- 25 Example of the organized order in which an organized quantity of the items of mail has to be present:

A-Street 1 → A-Street 8 → C-Avenue 1 → A-Street 3 →
B-Lane 5
→ A-Street 5 → C-Avenue 3 →
A-Street 2 → C-Avenue 5

5 The organizing operation then contains the following steps:

1. Transporting an addressed item of mail 3 from the quantity of non-organized items of mail past a reading arrangement into a free container 4 of the sorting arrangement
- 10 2. Determining the address or suitable information on the item of mail 3
3. Repeating steps 1 and 2 until all the non-organized items of mail 3 are located in each case in one container 1 of the intermediate store.
- 15 4. Transporting an addressed item of mail 3 from the quantity of organized items of mail past the reading arrangement into a free container 4 of the sorting arrangement (beginning with the item of mail which has the lowest place number).
- 20 5. Determining the address or suitable information on the item of mail 3.
6. Repeating steps 4 and 5 until all the organized items of mail 3 have passed the sorting arrangement.
- 25 7. (parallel to 6.) As soon as a first item of mail 3 is located above that depositing receptacle 2 in which, with account being taken of the address information read from all the items of mail 3 located in the containers 1, it should be deposited before all other items of mail in order to produce the desired organized order and, for the case where this item of mail 3 does not belong to the quantity of organized items of mail, at least a second item of mail is located in one of the containers 1, this being distinguished in that it belongs to the quantity of organized items of mail and is intended for said depositing

receptacle 2, the container 1 in which the first item of mail 3 is located is opened and the item of mail 3 is deposited in said depositing receptacle 2.

- 5 8. When all the containers 1 are empty, the items of mail 3 located in the form of sub-stacks 5 in the depositing receptacles 2 are removed therefrom in order and, if appropriate, combined to form one or more stacks.
- 10 9. Repeating steps 1 to 8, if appropriate, for the next address area.

Figure 6 shows the corresponding time sequence of these process steps with the following assignments:

- 15 Introduction = steps 1 to 3
 Pre-sorted introduction = steps 4 to 6
 Destacking = step 7
 Emptying = step 8

It is also possible here for the organizing operation with inclusion of pre-sorted items of mail for the current address area to be carried out while items of mail of the previous address area are still located in the containers 1 and are being conveyed into the depositing receptacles 2. This likewise increases the throughput and/or the time available for removing items of mail. Figure 7 illustrates the corresponding time sequence, in which

- 30 Introduction = steps 1 to 3
 Pre-sorted introduction= steps 4 to 6
 Destacking = step 7
 Emptying = step 8

An actual sorting run proceeds as follows:

Order of the non-organized items of mail (21 items) in the containers of the intermediate store:

C2-A6-B3-A1-C5-B3-A2-B8-C7-B6-A5-C4-B7-A8-C1-B8-
B5-C6-A3-C3-A7

Order of the organized items of mail (9 items, lower-case letters indicate that the items of mail belong to the quantity of organized items of mail):

a1-a8-c1-a3-b5-a5-c3-a2-c5

- 5 The following organized items of mail (3 items) are filled into containers of the intermediate store following the non-organized items of mail:

a1-a8-c1

- 10 The items of mail are then conveyed into the depositing receptacles.

- 15 6 items of mail are deposited during the 1st circulating cycle of the containers (figure 8a). The 6 containers which are becoming empty here are filled again with 6 organized items of mail during the same circulating cycle.

- 20 5 items of mail are then deposited during the 2nd circulating cycle of the pockets (figure 8b).

- 25 Since there are no longer any organized items of mail present to be filled into the containers, it is only the operation of sorting into the depositing receptacles which takes place in the next circulating cycles, without the containers being refilled (the containers which remain empty are indicated by **).

- 30 Then, in the correct order, 8 items of mail are conveyed into the depositing receptacles during the 3rd circulating cycle, 6 items of mail are conveyed into the depositing receptacles during the 4th circulating cycle, 4 items of mail are conveyed into the depositing receptacles during the 5th circulating cycle and the rest of the items of mail are conveyed into the depositing receptacles during the 6th circulating cycle (figures 8c - 8f).